67

Increasing the Viscosity of *Opuntia* mucilage Through the Alteration of its Ionic Environment

Jan Andries Viktor, Maryna de Wit, Garry Osthoff, Brandon van Rooyen

University of the Free State, Bloemfontein, South Africa

Abstract

Introduction: The ability to control the viscosity of mucilage from *Opuntia ficus-indica* and *Opuntia robusta* offers an opportunity for standardisation of different harvests or of mucilage from different sources, and to enhance its functional properties. Mucilage is a negatively charged polysaccharide molecule, and its viscosity is affected by its ionic environment, specifically by calcium ions. Controlling calcium ions therefore offers a way to control the viscosity.

Methodology: Freeze-dried *Opuntia ficus-indica* Mill. 'Morado' and 'Algerian' and *Opuntia robusta* mucilage was used. Chelating agents, specifically citric acid, creatine, ethylenediaminetetraacetic acid (EDTA), sodium hexametaphosphate and tartaric acid were used to bind the calcium in solution. They were added to individual samples at 1% w/w, based on polymer weight in solution, to reduce calcium levels naturally available in mucilage. The effect on viscosity was then determined via rotational rheometer and the use of specialised software. Calcium ions were then reintroduced in the form of calcium chloride, after which measurements were repeated.

Results and discussion: *Opuntia ficus-indica* Mill. spp. Mucilage decreased in viscosity following the addition of chelating agents and calcium chloride, except where sodium hexametaphosphate was added to 'Algerian' (mean 139,78 ± 41,31 mPa·s. Control 79,22 ± 12,26 mPa·s). In *Opuntia robusta*, viscosity increased beyond one standard deviation with citric acid (221,4 ± 73,11 mPa·s Control 71,56 ± 22,93 mPa·s), creatine (157,33 ± 29,94 mPa·s), EDTA (224,02 ± 80,24 mPa·s) and sodium hexametaphosphate (120,64 ± 28,98 mPa·s). This indicates that the viscosity of the samples can indeed be influenced by controlling the ionic environment of mucilage, but that the effectiveness was dependant on cultivar and species, as well as the specific chelating agents used.

Conclusion: The increase in viscosity following treatment with chelating agents and calcium chloride is indicative that controlling the ionic environment of mucilage controls its viscosity. This opens the door to further exploration, and to expand the potential use-cases for mucilage. It is also evident that there is more to be achieved by following this lead and exploring refinements of the technique.